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10/812,817	03/29/2004	Daniel I. Some	008369USA	5107

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EXAMINER	
ROSENBERGER, RICHARD A	
ART UNIT	PAPER NUMBER
2877	

DATE MAILED: 02/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/812,817	Applicant(s) SOME, DANIEL I.	
	Examiner Richard A Rosenberger	Art Unit 2877	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *27-46* is/are allowed.

6)☒ Claim(s) *1-15 and 18-26* is/are rejected.

7)☒ Claim(s) *16 and 17* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/25/04*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Nonoka et al (US 5,834,661).

As in claims 1, and 11, the reference shows a method of identifying a defect in a substrate, the method comprising: imaging (by means of camera 7) an area of the substrate (1) with and without application of heat (by means of thermoplate 2), to

obtain a hot image and a cold image respectively; comparing at least a portion of the hot image with a corresponding portion of the cold image (by subtraction processing (as in instant claim 11); column 3, lines 61-64 and column 32-37); and providing an indication about a suspected defect in response to the comparison ("the position and shape of the defect", column 5, line 37-38).

5. Claims 2-11 and 18-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nonoka et al (US 5,834,661) and Crisman (US 5,292,195), taken together, with the discussion of what is already known in the art in the instant specification.

See above for a discussion of Nonoka et al relative to claim 1 from which these claims depend. Crisman shows a similar system in which an object is inspected for defects by heating it (by means of energy source 9) and images obtained (by means of camera (11).

Nonoka et al provides images, and disclosed that defects can be seen in the images. The images are of course recognized by some area in the images being significantly "wrong", that is, significantly different from what it would be in the absence of the defect. This requires at least some knowledge of what the "good" image can be assumed to be. Crisman teaches for this an explicit comparison with another object, the differences being indicative of errors (column 2, lines 14-19). It would have been obvious to use such a known earlier obtained "assumed good" image, as taught by Crisman, in the system of Nonoka et al because the system of

Nonoka et al requires obtaining knowledge of what an defect-free difference image is so the defect can be recognized in the test image. As in claim 3, such comparison with an earlier obtained difference image in Nonoka et al for detection of a defect will comprise checking whether said results differ significantly relative to previous results of said comparing, that is, the earlier formation of the difference image by subtraction processing.

The instant specification notes that it is known in the art to use different areas of the same object for this as the basis of the comparison (instant specification, paragraph [0013], page 4). It would have been obvious, as in claims 21 and 23, to so use a different area as the reference image in the system of Nonoka et al because this is a known technique for obtaining reference images and does not require a separate reference object that requires separate measurement with the handling that that requires. Although claim 21 refers to the different areas as being "dies" and claim 23 as "cells", there is not particular limitations in either claim to limit either term to more than being different areas.

As in claim 4, the recognition of a defect requires some degree of significant difference and not merely any difference whatsoever; it will not be the case that the two images, the good image and the test image, will always be exactly the same. Thus, for a functioning defect detection system, there must be some value of what is a significant difference and that below which is not a defect. As in claim 5, this value defining what a significant difference indicating a defect as opposed to merely

normal variation will necessarily depend on (or be "responsive to") the type of material expected to be present, and size and geometry of a feature to be fabricated.

Nonoka et al teaches the images "are processed by an image processor 8" (column 3, lines 22-23), but, other than the subtraction processing (which is presented as an example, not as the only option, see column 3, line 23: "for example, ...") does not discuss the types of processing that can be used. Crisman also teaches processing the images (column 5, lines 26-32), being explicitly that any appropriate "well known image processing technique" (column 5, lines 31-32) can be used. The claimed image averaging (claim 2), adjusting the intensity ranges in one or both images to form a "clean" images by the subtraction processing (claims 6, 7, 8), adjusting the gain offset (claim 9), and normalizing the images before subtraction (claim 10), are all types of well-known image processing techniques of the sort Crisman notes can be used, and official notice of the fact that these are well-known techniques is taken.

As to claims 18-20, the claimed camera designs are known camera designs; the instant specification presents both as commercially available designs (paragraph [0076] on page 28 for claims 18 and 19, and paragraph [0035] on page 9 for claim 20]. It would have been obvious to use any known type of camera because it is the imaging per se, and not the particular details of the camera use of obtain the images, that is of functional importance and that makes the system operable. Thus use of either type of camera, with either a linear or an area array of detectors,

will result in simultaneously making a plurality of measurement (on for each detector in the array" for both the hot and cold images (claim 24).

6. Claims 2 and 12-15, 25 and 26 are is rejected under 35 U.S.C. 103(a) as being unpatentable over Nonoka et al (US 5,834,661) and Crisman (US 5,292,195) as applied above, and further in view of Lichtman (US 5,099,363).

See above for a discussion of Nonoka et al and Crisman. Nonoka et al and Crisman do not explicitly teach averaging a plurality of images together, although both, and in particular Crisman, do teach the application of known image processing techniques to enhance the images. It is known in the art to average several images of an object together; Lichtman, column 7, lines 51-54, for example, teaches averaging a plurality images together to "thus improve the signal-to-noise ratio by signal averaging". It would have been obvious to average a plurality of images together in this known manner because, as recognized by Lichtman, it is a known technique for improving the signal-to-noise ratio of the images, and thus the measurement base upon those images.

To obtain the plurality to images needed for this known technique of improving signal-to-noise ratio, it would have been obvious to obtain them through repeatedly applying and not applying heat to the same area; and imaging the same area after each repeated applying and after each repeated not applying (claim 12) because this would produce the required plurality of images and would average out

better any possible variations in temperature of the like that would arise in any single heating and cooling cycle.

Functionally, in the system of Nonoka et al, it is needed to obtain two images at different temperatures. It would have been obvious to obtain the images at any convenient times during the cycle, obtaining the hot images either during (claim 13) or after (claims 14, 15) the heating (but before the object has completely cooled) because this is when the object is at the high temperature, and the cold image between heating cycles (claims 14, 15) after the object has sufficiently cooled because this is when the object is at the lower temperature so that the necessary temperature difference is present between the images. Once the cold image is obtained, it would have been obvious to immediately begin the heating cycle again (claim 15) because, as the cold image has been obtained, there is no reason to wait to heat the object again for the next hot image.

As set forth above (see the comments relative to claim 21 above), it is known to use other areas of the same object as the comparison or reference object. Averaging several of the adjacent areas, as in claims 22, would have been obvious because, as discussed above, averaging is a known technique of improving the signal-to-noise ratio, and averaging different areas known to be substantially the same will produce the added benefit of serving to eliminate, or at least reducing the effects of, possible variations, either normal variation or, in extreme cases, defects, in the reference areas.

As in independent claim 25, Nonoka et al shows method of identifying a defect in a substrate, the method comprising: heating an area of said substrate (1); imaging said area (by camera 7) while heat is dissipating therefrom, thereby to obtain a hot image; imaging said area either prior to said heating or after a majority of said heat is dissipated, thereby to obtain a cold image; and comparing the hot image with the cold image to obtain a differential image (by subtraction processing to form a differential image; column 3, lines 61-64 and column 32-37).

Nonoka et al does not use "a heating beam" as claimed. It is known to use a heating beam to heat the object in such tests; see Crisman, which used a heating beam (such as a quartz lamp, a xenon flash lamp, or a movable lamp; see column 2, lines 59-62). It would have been obvious to use this known heating means rather than the heating means of Nonoka et al because, as shown by Crisman, it is known to do so, and heating the surface being viewed rather the having to heat the entire object form behind will result in a faster temperature change on the area of interest and thus speed up the measurement.

As set forth above, it would have been obvious to repeat the heating, imaging and comparing; and it is known to average the resultant images at each location across all differential images, to obtain an averaged differential image to improve the signal-to-noise ratio.

The Nonoka et al reference teaches identifying a location as having said defect, such a defect recognition requires the determination of whether a value in the averaged differential image at said location differs significantly relative to

corresponding values at other locations, the location on the reference object or areas.

As discussed above, the selection of the reference areas must be selected based upon such features as they type of material expected to be present, the size and the geometry of a features because the reference areas must be expected to mirror the image of the object being inspected if no defect is present, which requires that there be no significant differences in the areas to be compared.

7. Claims 16 and 17 appear to contain allowable subject matter, but are objected to as being dependent upon unallowed claims. The are does not teach or suggest the claimed "probe beam" of claim 16 in a method comprising "imaging an area of the substrate with and without application of heat" in combination with "... comparing at least a portion of the hot image with a corresponding portion of the cold image ..."; Neither does the art teach or suggest the method in which the "heat is applied by a laser beam" and also "said laser beam also illuminates said area at least during imaging, said laser beam having a lower intensity during illumination for imaging than during applying of heat."

8. Claims 27-46 are allowable. The art does not teach an apparatus in which a heating source, an illumination source for illuminating the area being heated by the heating source, and a plurality of sensors for obtaining a hot image and a cold images of the area as in claims 27. The art does not teach or suggest the subject

matter of claim 39, in which there is an apparatus comprising two sources of electromagnetic and a plurality of photodetectors sensitive to electromagnetic radiation from the second source, in which there is a switching circuit with the claimed functional relationship between the two light sources and detectors.

9. Rosencwaig et al (US 4,679,946) shows a device and method similar to that of the claimed. In particular, there is first source of electromagnetic radiation, which is a heating beam which heats the substrate being tested (column 11, lines 53-62). There is a second source of radiation (50) which provides a probe beam which illuminated the area heated by the heating beam (column 11, lines 61). There are a plurality of sensors (the two halves of the bicell detectors 56 (see figure 4, and column 14, lines 1-10). The system detects the change of reflectivity of the surface that results from a change in temperature due to the heating be the heating beam (column 6, lines 39- 65), which is a difference between the surface reflectivity at two different temperatures. There is a least a suggestion in Rosencwaig et al that a resultant difference image be obtained (column 15, lines 20-23). There is, however, no teaching or suggestion of obtaining a hot image and a cold image, and comparing the two, as in claims 1 (and thus 16 and 17), 25, 27, and 39. In Rosencwaig et al the difference in reflectivity is obtained in a manner in which the two separate images are not, and cannot, be separately generated as claimed; in Rosencwaig et al the signals are passed through narrow bandwidth filters (column 6, lines 65-67) in which "only the periodic reflectivity signal ΔR_T as a result of the periodic surface

temperature variations ΔT is measured, rather than the absolute reflectivity R_T". The "hot image" and the "cold image" of instant claims 1, 25, 27, and 39 are absolute reflectivity images at the two different temperatures, which Rosencwaig et al does not measure, and the narrow band pass filters approach of Rosencwaig et al is not the switching circuit of claims 39.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard A Rosenberger whose telephone number is (571) 272-2428. The examiner can normally be reached on Monday through Friday during the hours of 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr. can be reached on (571) 272-2800 ext. 77. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

R. A. Rosenberger
8 February 2005

Richard A. Rosenberger
Primary Examiner